

Erratum: “A simple, analytical model of collisionless magnetic reconnection in a pair plasma” [Phys. Plasmas 16, 102106 (2009)]

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The following describes a list of errata in our paper, “A simple, analytical model of collisionless magnetic reconnection in a pair plasma.”¹ It supersedes an earlier erratum².

We recently discovered an error in the derivation of the outflow-to-inflow density ratio. Specifically, eqn. (23) contains an erroneous, additional factor of n_o^{-1} . This error leads to three changes to subsequent equations, and to quantitative changes in the figures. We regret this error. The correct version of (23) should read:

$$d^2 \left(1 - n_o \frac{u_i}{u_o} - n_o^2 \frac{\gamma - 1}{\gamma} \right) = - \frac{\gamma - 1}{\gamma} p_o \left(\frac{1}{n_o} + n_o \right) \quad (23)$$

This result changes two additional equations. Eqn. (24) now becomes:

$$1 - n_o \frac{u_i}{u_o} - n_o^2 \frac{\gamma - 1}{\gamma} = - \frac{\gamma - 1}{2\gamma} (1 + n_o^2) \quad (24)$$

which now leads to a quadratic rather than cubic equation for n_o .

$$n_o^2 + \frac{2\gamma}{\gamma - 1} n_o - 1 - \frac{2\gamma}{\gamma - 1} = 0 \quad (26a)$$

This equation is readily solved analytically:

$$n_o = -\frac{\gamma}{\gamma-1}\varepsilon + \left[\left(\frac{\gamma}{\gamma-1}\varepsilon \right)^2 + 1 + \frac{2\gamma}{\gamma-1} \right]^{-1/2} \quad (26b)$$

The subsequent analysis is unchanged. The revision of (26) leads to qualitatively very similar results, and all original conclusions remain valid. The revised figures are shown below.

REFERENCES

¹ M. Hesse, S. Zenitani, M. Kuznetsova, and A. Klimas, Phys. Plasmas 16, 102106 (2009)

² M. Hesse, S. Zenitani, M. Kuznetsova, and A. Klimas, Phys. Plasmas 16, 129906 (2009)

Figures and captions

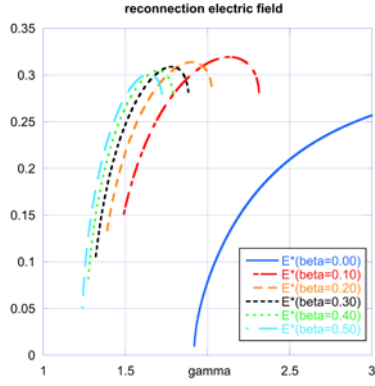


Figure 1 (color online). Reconnection electric field depending on inflow plasma β and polytropic index γ .

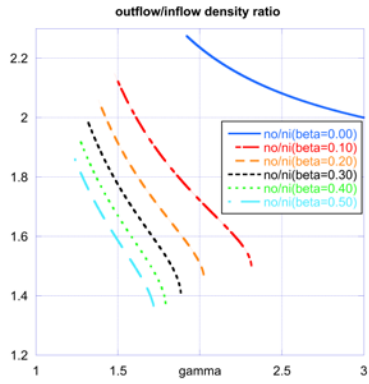


Figure 2 (color online). Ratio of outflow and inflow density, depending on inflow plasma β and polytropic index γ .

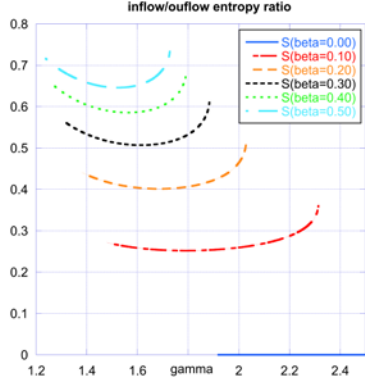


Figure 3 (color online). Entropy ratio $p_i n_o^\gamma / p_o n_i^\gamma$ depending on inflow plasma β and polytropic index γ .

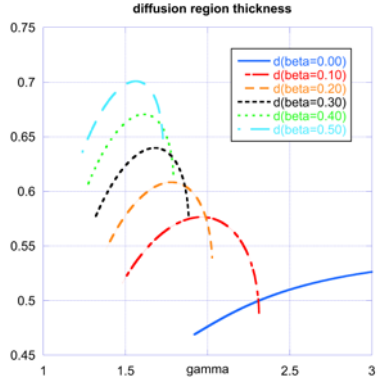


Figure 4 (color online). Diffusion region thickness d depending on inflow plasma β and polytropic index γ .

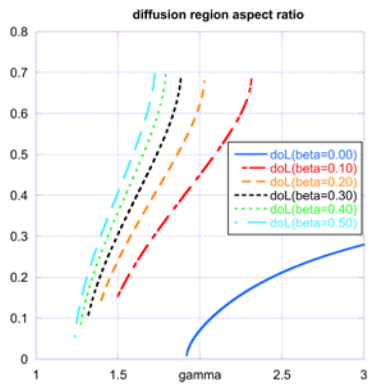


Figure 5 (color online). Diffusion region aspect ratio d/L depending on inflow plasma β and polytropic index γ .

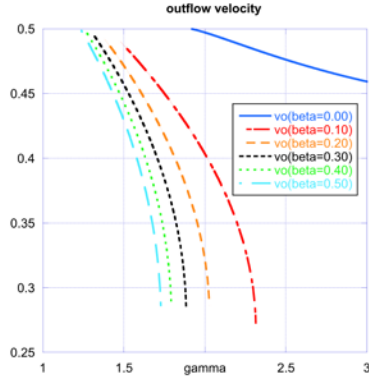


Figure 6 (color online). Outflow velocity depending on inflow plasma β and polytropic index γ .

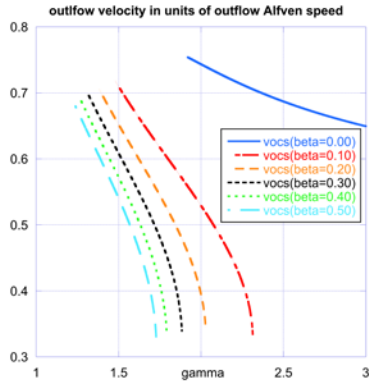


Figure 7 (color online). Outflow velocity based on outflow density depending on inflow plasma β and polytropic index γ .

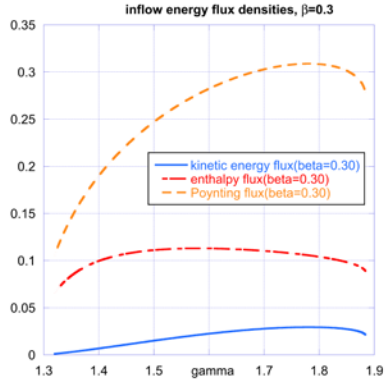


Figure 8 (color online). Inflow energy flux densities for upstream $\beta=0.3$.

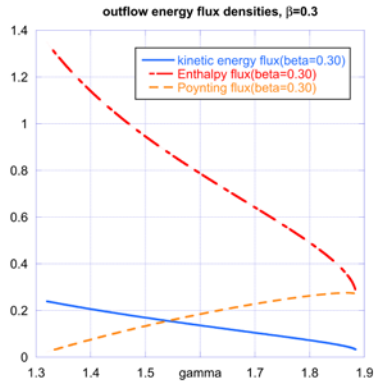


Figure 9 (color online). Outflow energy flux densities for upstream $\beta=0.3$.

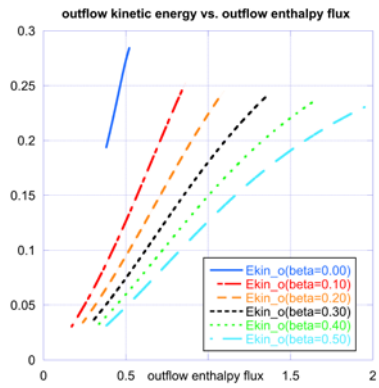


Figure 10 (color online). Outflow kinetic energy flux density plotted versus enthalpy flux density for all parameters. The lower fluxes are obtained for larger values of the polytropic index γ , with the exception of the $\beta=1$ calculation. Here, lower values of γ yield larger kinetic energy but lower enthalpy flux densities.

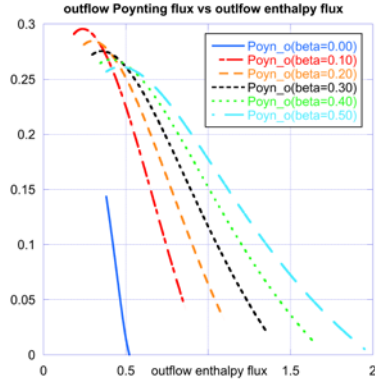


Figure 11 (color online). Outflow Poynting flux density plotted versus enthalpy flux density for all parameters. Here higher Poynting fluxes are obtained for smaller values of the polytropic index γ , again with the exception of the $\beta=1$ calculation. Here, lower values of γ yield larger kinetic energy but lower enthalpy flux densities.